September-October 1951

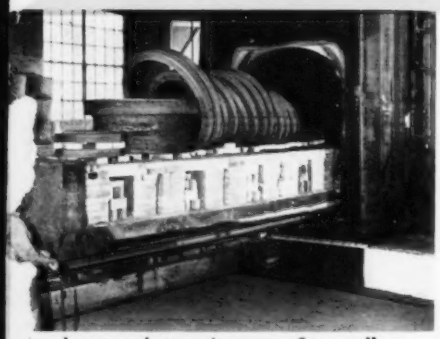
METAL TREATING

MASTER CRAFTSMEN
METAL TREATING INSTITUTE

JOURNAL OF THE METAL TREATING INSTITUTE

National Trade Association of

COMMERCIAL HEAT TREATERS



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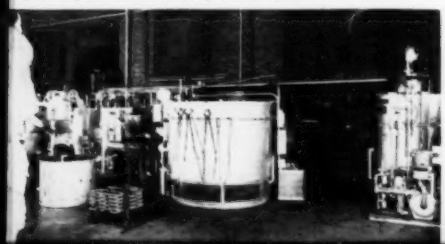

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☐ Armor piercing shot and caps
☐ Armor plate ☐ Land mine parts
☐ Jet engine bearing races

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☐ AIRCRAFT gas turbine gears ☐ landing gears ☐ piston engine parts ☐ supercharger parts, etc.
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☐ Rocket motor bodies
☐ Automatic pistol parts
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☐ Armor plate
☐ Gun breech block parts

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☐ 20-mm machine gun parts
☐ 40-mm Bofors gun parts
☐ Tank engine camshafts ☐ engine gears ☐ armor plate ☐ torque converter parts ☐ tread pins, etc.
☐ Aircraft gas turbine gears ☐ clutch rings
☐ Armor piercing shot
☐ Rocket fuse bodies

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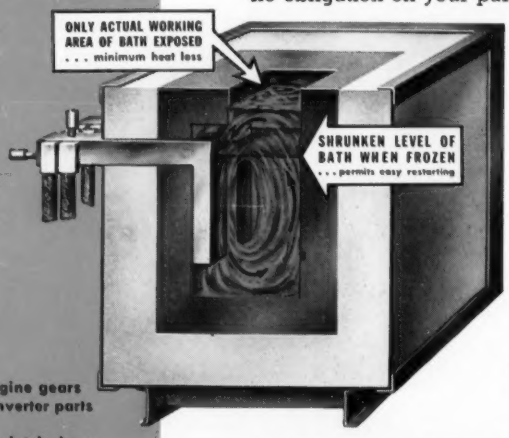

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Editorial...

ONE WAY TO REDUCE YOUR STOCKPILE OF PROBLEMS

It seems, as we look back over the past few years, that each one recently has contributed a steadily accumulating pile of harassments, – a growing stack of annoying problems, obstacles and irritations. These have fallen not only upon individuals in general but upon the metalworking industry in particular. Furthermore, that vital segment of this great industry; namely, the heat treating of metals, has of course received its full share.

Those once simple but now "bugaboo" words–*shortages, allocations, controls, directives, regulations*–today constitute the framework of the difficulties we have in mind.

However, that old saying about the "ill wind" that always blows someone some good is being proved within many industrial groups today. For much good is being accomplished by those industries which have recognized their common interests through the establishment or strengthening of a trade association. For it is through these trade associations in the metalworking field and, of course, in the heat treating branch of it, that cooperative and coordinated effort have led to the solution of many problems and the easing of heavy burdens. Everywhere it has been proved that there is much more to be gained from exchanging ideas and information than from hiding them. It is obvious, of course, that small businesses get more out of such interchange than big ones and at greatly reduced costs.

The subjects delegated to and worked upon by the modern trade association are too numerous to enumerate here. To mention just a few of them, they include: Publications, government information, statistics, labor relations, insurance, merchandising. Each of these represents a business problem important to every individual concerned. The combined talents and teamwork of the officers, committees and members of a trade association can be concentrated upon any or all of these business factors to your benefit.

Plan now to support your group, or your society, resolve not to be a free rider–be willing to work and serve. By this means you can do a lot to make 1952 a year of a *diminishing* stockpile of harassments and problems.

METAL TREATING

Official Journal of the Metal Treating Institute

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FEATURES

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Why Not Insured Heat Treating?

By Horace C. Knerr, *President*
Metlab Company
Philadelphia 18, Pa.

Risk is a factor present in some degree in every business transaction. Modern businessmen are on the alert to find ways to minimize their risks. In some fields this is accomplished by hedging operations. In others, insurance is the answer. Insurance underwriters are constantly being called upon to develop policies to meet new situations.

Heat treating is a field inherently involving considerable risk. It must cope with many variables such as chemical composition, temperature, atmosphere, design factors, deformation, etc. A slight deviation in any one of the variables may spell the difference between success and failure. On top of this there is the human element. Heat treating, while highly developed from the scientific standpoint, is and always will be in many respects an art, depending on the skill and the judgment of the operator.

Despite the many hazards, the record of losses and claims among the members of Metal Treating Institute has been remarkably small. As to any single job, however, a loss may be large. Few homes burn down, but all prudent people carry insurance because if a loss does occur, it may be very serious.

Value Ten Times Cost

The amount of the heat treating charge does not necessarily bear any relation to the value of the material treated. It has been estimated that, on the average, the value of the article is ten times the amount of the heat treating charge. Wide fluctuations above and below the average occur of course. In some cases, the amount invested in a particular part or assembly as it reaches the heat treater may actually be hundreds of times his charges. Despite his best care, the piece may be spoiled. A hoist may break, power or fuel fail at the critical moment, a furnace hearth may break down, a retort burn out, a temperature control instrument go out of adjustment or an artificial atmosphere generator malfunction. Rupture or harmful deformation may occur. The operator may even subject the parts to the wrong treatment.

When it is considered that the commercial heat treater hopes for an average profit of only about 10% of his gross sales, it is evident that his charges do not provide a margin sufficiently large to absorb the occasional large loss (any more than a man's income normally permits him to purchase a new house in case of fire).

For example, a heat treater handles a die costing $1,000. His charge for heat treating service might be $50, on which he hopes to make a profit of $5 or $10. Suppose the die is lost and the customer claims replacement costs. The heat treater would have to make a perfect score on 200 more dies or similar work amounting to $10,000 before earning enough to cover the $1,000 loss.

Doing business on such a basis would be disastrous and soon there would be no more commercial heat treaters.

Manufacturer's Risk

It must be kept in mind that the manufacture of a die or other part requiring heat treatment involves a risk. If the manufacturer does his own heat treating and loses the piece he expects to absorb the loss as part of the manufacturing cost. Some industrial plants find their write offs quite high on this ground—often from 10% to as high as 50%. Others, ostrich fashion, fail to keep account of these losses and pretend they do not occur.

When a commercial heat treater handles the job, the same inherent hazards are present. But the successful commercial heat treater, being a specialist, is able —and must be able—to keep the percentage of losses much smaller. He therefore greatly *reduces* the loss hazard so far as his customer is concerned.

Competition compels him to charge only for the operations he performs. He is obligated to do his work with reasonable care and skill. If he included a premium to cover the risk, based upon the value of the article, his prices would be much higher and his customer might go elsewhere. Most customers recognize the validity of these principles.

M.T.I. Limited Liability Clause

Members of MTI long ago adopted and announced to their customers a policy expressed aproximately as follows:—

Your Work is Accepted Subject to the Following Conditions:

It is generally recognized that even after employing all the science known to us, and capable men with years of training, there still remain hazards in heat treating. Therefore, our liability to our customers shall not exceed our charges for the work done on any material, except by written agreement. Warranty will be assumed by us only when made in writing and signed by both you and us. In such event a higher charge will be made for our services. No claim will be allowed for shrinkage, expansion, deformation or rupture of material in treating, except by written agreement, as above nor in any case for rupture caused by subsequent grinding.

It is a well-known legal principle that one cannot evade responsibility for one's own negligence. The question frequently arises whether an unsatisfactory result in heat treating is due to normal risks in the operation, to unsuitable metal, or to negligence on the part of the heat treater.

Members of MTI try to be scrupulously fair, and to accept responsibility if it is evident that the fault is theirs. A tendency to blame the steel is being superseded by a policy of cooperation and consultation with the warehouse or mill.

When he can, the competent commercial heat treater advises the customer in the blue print stage regarding selection of material and details of design. Where practicable, he checks the work before starting operations. This is preventive medicine.

But risks and causes for disagreement still remain.

Sometimes these find their way to court and jury. Inevitably delay, expense and ill feeling result.

Proposed Insurance Provisions

The combination of remote contingency and high value in relation to charges provides a situation to which insurance appears to be the logical answer. The Metal Treating Institute has for some years been trying to work out a satisfactory insurance plan. Because it was a field in which they had not accumulated experience, underwriters were shy. After a long and persistent search, however, one of the best known insurance groups in the world has submitted a proposal to our organization. They offer to insure MTI members for claims brought against them for legal liability for loss or damage resulting from errors, omissions or faulty workmanship in the handling or processing of metals in the course of their business.

They propose a limit of $25,000 on any one job, subject to $200 deductible which the heat treater would pay. The premium would be a percentage of the heat treater's gross billings and all work, not just selected jobs, would be insured. Based upon the ten to one ratio of value to charges, the cost would average less than ½ of 1% of the value of the customer's goods. The rate would be subject to adjustment on the basis of experience as time goes on. Nothing would prevent the heat treater from making voluntary adjustments at his own expense, regardless of his liability.

Exclusive with M.T.I. Members

The insurance plan would be limited to members of Metal Treating Institute in good standing. It is a policy of the Institute that no concern is accepted as a member of the Institute unless it can demonstrate a high quality of workmanship as well as financial stability. The customer would be further safeguarded by the deductible clause which would tend to keep the heat treater on his toes as well as to eliminate nuisance claims.

It is proposed that the heat treater add an insurance premium to the customer's invoice as a separate item and to set aside the proceeds in a separate account to cover insurance costs. It may well be asked why the customers should pay to insure something for which the heat treater is legally liable. A little reflection will show that this is perfectly reasonable. The purpose of insurance is to reimburse the interested party—in this case, the owner of the goods—for the loss of his property. He does not want to leave it to chance nor does he want to rely solely upon the financial stability, attitude, willingness or even whim of the one to whom he has entrusted his property. He wants to avoid law suits. In short, he wants to play safe.

Automobiles and trucks are insured against damage done by the other fellow. In the transportation of goods by common carrier, shippers often insure their merchandise in transit. Passengers in railways and aircraft purchase accident insurance for the trip. Many laundries charge the customer a small extra fee per bundle to cover insurance against loss or damage. Other instances might be cited. In all of these cases, the owner pays the cost of insuring his property or himself against loss despite any legal liability on the part of the one rendering the service.

Unjustified Claims

The heat treater must constantly be on his guard against unjustified claims, many of which are presented in entire good faith. He cannot analyze, test and measure every piece of metal presented to him. Yet, entirely unknown to the customer, there may be a hidden defect of some kind in the material causing the piece to crack or otherwise fail in heat treating. A steel may be abnormal and not respond to orthodox treatment. The metal may be of a quality unsuitable for the purpose intended or of a composition involving unnecessary risk in the hardening operation – for example a water hardening steel where an oil hardening steel should be used. The steel may have latent defects such as segregation, pipe, or seams. Since the purpose of heat treating is to change the characteristics of metals, this very change may make it extremely difficult to determine the actual cause of failure and place the responsibility.

The buyer may not purchase stock with sufficient allowance for cleaning up before heat treatment, or the machine shop may fail to remove surface "bark" (seams, decarburization, etc.), or not remove it uniformly on all sides.

The customer may misinform the heat treater as to the composition of the metal, or may specify a heat treatment not best suited to the job.

Deformation beyond specified tolerances in critical cases may result from neglect to stress anneal the material before final treatment.

Parts, particularly forgings, may be sent to the commercial heat treater already containing latent cracks, seams or forging defects which will open under the strains of hardening no matter how skillfully performed.

Insurance is *not* intended to indemnify against such avoidable risks and is not to be used to cover up carelessness or indifference either on the part of the heat treater or his customer, and certainly not against dishonesty.

One Year Trial Period

The plan provides for a trial period of a year, with reappraisal of conditions and readjustment of rates at the end of that time.

The answers to many questions will have to be worked out before a smoothly operating arrangement is found. It will require much careful study by the Institute, its interested members, and by the representatives of the Insurance Company.

The customer will have to be educated as to the meaning and purpose of Insured Heat Treating.

A good insurance plan will not only provide protection for Institute members and their customers at small cost, but will inevitably tend to raise the standards of the industry and still further reduce losses and costs, as time goes on.

Remember what health and accident insurance, with the accompanying safety campaigns have accomplished in that important field.

Why not work for similar results in heat treating?

New Wet Blast Machine Designed Through Field Research

By E. E. Brodhag, *Engineer*
American Wheelabrator & Equipment Corp.
Mishawaka, Indiana

The use of wet blasting for removing heat treating scale from metal surfaces is one of our newest cleaning processes, but it is steadily gaining popularity because the quality of the surface obtained can be so closely controlled. Although abrasive blasting with dry metallic grit has long been used for removing scale which formed on metal parts during annealing, normalizing, and tempering operations, it has been felt that for certain cases, a less severe means of cleaning was needed. This is true, particularly, in the case of work which is to be manufactured to very close tolerances and which is characterized by thin-walled sections, very sharp-edged protuberances, or pieces to be mated together. Wet blasting is truly the most suitable method, as the severity of abrasion is a function of the size of abrasive used, and the small-sized abrasive needed in these applications cannot be efficiently handled in the dry state. Continuous research has been carried on during the past few years in an effort to obtain the maximum in performance and efficiency from this relatively new tool in the metal-working industries. Tolerances of .0001" can be maintained through the use of very fine mesh abrasive.

A new design in this type of equipment has been introduced by American Wheelabrator & Equipment Corp., Mishawaka, Indiana. Named the "Liquamatte," it is a wet blasting machine in which the abrasive slurry is propelled by compressed air and recirculated by a vertical-type pump, and is a result of an extensive field research program in which design engineers consulted heat treating and other metal-working engineers in typical plants to get their ideas on what was needed in the way of new wet blast equipment.

The marketing of the new product is, incidentally, a step in conformity with the company's long-established policy of providing all types of blast cleaning equipment to the metal working and heat treating industries. Goals we strove for were a machine with improved operating characteristics and less need for maintenance, and a machine that would make a cleaning job easier.

We took note of the various wet blasting problems facing production men before we proposed a "Liquamatte" design. We then took this design out into the field and asked officials in charge of metal processing plants what suggestions they had to offer in the way of improvement changes and additions. Based on first-hand knowledge of their own requirements, these officials described to us the type of machine they wanted. We knitted their suggestions together in designing the new machine.

The unit is designed to use a silica-type abrasive in sizes ranging from 80 to 2500 mesh. Heat treating oxide can be removed from such items as precision-built aircraft parts, spring stock, tools, dies, and plastic molds, without destroying close tolerances. (Fig. 1-3.)

The model presently in production is the model 43 Liquamatte, which is four feet long, three feet wide, and 6′ 8¾″ high overall. It can be equipped with either hand rinse tanks or the power rinse tank which is shown in the illustration. (Fig 4.)

Another size, the model 64, will be in production in a short time. Its dimensions will be six feet in length, four feet in width, and although the exact height is not yet determined, it is expected to be about 18 inches taller than the model 43. The same type of rinse tanks will be used with this model as with the 43.

For commercial heat treating establishments, the power rinse tank is probably the more suitable, because it is provided with tracks so that the work car can be rolled out from the blasting compartment onto the tank. There, loading and unloading of heavy pieces can easily be performed with a crane, and a machine of maximum versatility is available. Both hand rinse tanks and the power rinse tank are offered with electrical heating units, which gives faster drying with less chance of oxidation.

Fig. 1—View of forging die after having been heat treated. Black scale covering the die must be removed without destroying the close tolerance of the part.

Fig. 2—View of heat treated forging die, half of which has been untouched by a cleaning process, and the other half of which has been cleaned by wet abrasive blasting. The abrasive used on this piece is 325 NE Liquabrasive.

A feature of the tank is a pump which permits rinsing of ferrous parts, as well as non-ferrous parts, without the occurrence of rusting. When ferrous metal is being processed, tap water cannot be used for rinsing the work, because of incipient rusting, so a rinsing mixture of water and anti-rust chemical is held in the rinse tank, pumped through a hose, and sprayed over the work.

Abrasive and water are charged into the machine through the blasting compartment. The water is first run into the hopper to a level indicated by a line, and the abrasive, which is furnished in powder form, is placed on a board in the blasting compartment, so that it can be gradually mixed in with the water. This eliminates lumping of the abrasive and the occurrence of floating particles. The pump is started and with only the pump circulating the water, the abrasive is gradually washed off the board and thoroughly dispersed. However, when blasting is in process, air at from 80 to 100 psi pressure is used for giving the slurry added energy, and it is controlled by a knee-operated valve on the front of the cabinet. Another knee-operated valve located nearby operates the washing mechanism for the vision window.

Work is inserted into the blasting compartment through the armholes of the cabinet (since the gloves are unattached to the gauntlets) or through either of the counterbalanced vertical sliding doors on the ends of the cabinet. Work such as heat treated drill bits can be inserted and removed through the gauntlets, but heavy dies, and similar sized parts are rolled in and out on the work car. The power rinse tank has likewise been designed so that there are no horizontal surfaces to catch dripping slurry that comes out with the work, so rinsing of the tank structure is kept to a minimum.

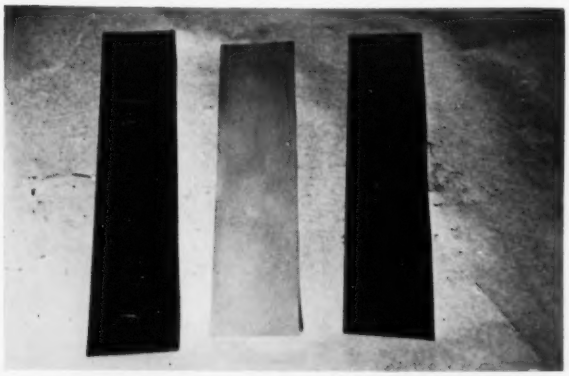


Fig. 3—View showing comparison of heat treated steel spring strip before and after cleaning by liquid abrasive blasting.

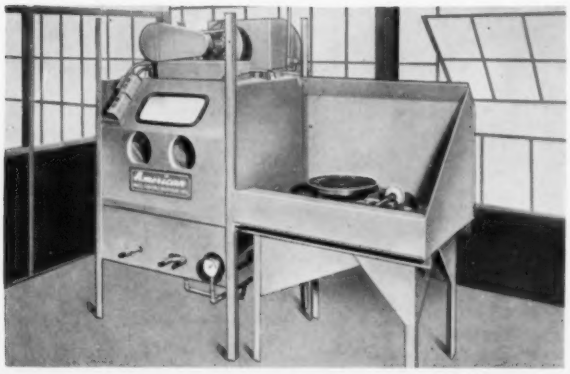


Fig. 4—View of the Liquamatte, a new wet blast machine introduced at the National Metal Exposition by American Wheelabrator and Equipment Corp.

Among the special features on this machine is the vertical pump for slurry recirculation and agitation. Because of its position in a well on the back of the cabinet, it eliminates all suction piping, valves, and fittings, and it can be easily inspected without much labor expense. It is always primed by flooded-type suction, and the operation of valves for starting or stopping is unnecessary. Loss of slurry through leakage is eliminated because there are no packing glands. Abrasive can't plug the pump impellor when the machine is shut down, and the hopper need not be drained before the pump is removed.

The machine has a low work ceiling, but the bottom is high enough off the floor to make good housekeeping possible. Rubber hose has been used instead of metal pipe wherever possible. Not only is this an advantage from a maintenance standpoint, but it eliminates noise from water hammer.

A reset timer is available on the Liquamatte which tells at a glance the number of blasting hours that the abrasive has been in the machine. It lets the operator know when to change abrasive and makes it easier for him to avoid wasting abrasive. When the abrasive does need changing, the operator doesn't need to bail out slurry or handle it in any way. An air ejector is available for blowing the slurry through a length of hose, either to a sump pit or to barrels.

Because of the nature of the process, the atmosphere inside the cabinet has a tendency to become foggy due to finely dispersed slurry in the air. A ventilating fan keeps the concentration of dispersed droplets to a minimum by drawing air out of the cabinet. Entrainment of abrasive particles in the air discharged from the cabinet is prevented by two corrosion-resistant air filters, and they are positioned so that all of the air passes through each one. Tap water is used for rinsing the illumination window, the vision window, and the air filters, and water from the vision window and air filters is caught in small troughs and carried to a sedimentation tank in the rear of the cabinet. Water from the illumination window runs to the hopper, because, since fluorescent lights are used, there is no baking of abrasive, and water from rinsing is negligible.

It is expected that with the combination of dry and wet abrasive blasting, cleaning problems of both the commercial and industrial heat treater will be more easily solvable. Versatility of the cleaning department will be increased, to meet the three-fold challenge of modern metalworking—better quality, faster service, and lower cost.

Distortion of Tool Steels in Heat Treatment

By J. Y. Riedel, *Tool Steel Engineer*
Bethlehem Steel Company
Bethlehem, Pa.

Concluded from July-August "Metal Treating"

The prediction of distortion of tool steels is further complicated by other factors, the most important of which are:

a. Scaling

In the majority of commercial heat treating equipment, it is found that steels will scale during heating for the quench. The loss of metal due to scaling cannot be ignored since the loss is in the same order of magnitude as the size changes resulting from heat treatment. In some instances, the scaling is an advantage from the distortion viewpoint since it tends to counterbalance expansion which occurs in hardening. (Of course it will likewise increase the magnitude of shrinkage which might occur). As a matter of fact, the great reputation of the Mn oil-hardening type of tool steel as a non-deforming steel is to some degree based upon the fact that the scaling, which occurs in heating for hardening, almost counteracts the expansion which most often occurs during hardening of this grade. Therefore, in new furnaces which prevent scaling, tool steels may appear to expand more than when treated in older equipment. Also, it should be recognized that salt baths usually do not prevent scaling, although they appear to do so. Actually scaling occurs but the scale is dissolved by the salt so that it is not visible. However, the short holding time in salt baths helps to reduce the loss due to scale.

b. Variation in Quenching

Variation of quenching temperature, either above or below the recommended range, will usually have a pronounced effect upon distortion. In general, high temperatures tend to promote retention of austenite, which may decrease the expected expansion or increase shrinkage; lower temperatures promote more complete martensite formation with accompanying increase in expansion. Other factors in the quench such as temperature and viscosity of quenching medium, degree of agitation, etc., will also effect distortion insofar as they may affect the completeness of the austenite-martensite transformation.

c. Tempering

Fundamentally, the tempering operation causes decomposition of martensite, and, on the hardened tool steel, would be expected to counteract some of the expansion effect resulting from martensite formation. This effect is actually noted in most tool steels to an appreciable extent.

Table IV, below, shows the amount of volume change produced by a 400°F temper on some typical steels.

Due to the fact that it is unsafe to measure tools, particularly liquid quenched tools, in the as-quenched condition, the distortion is usually measured only after tempering. The inherent distortion "factors" usually have been corrected for the size changes produced by tempering, and thus can be used directly in predicting size changes from the annealed state to the hardened (quench plus temper) state.

The use of progressively higher tempering temperatures will eventually eliminate the size changes resulting from inherent distortion but at that point the tool will have lost all the hardness produced by quenching and the structure will consist of ferrite and carbide, as in the annealed condition. Thus, this method is of no practical value.

d. Measurement of Dimensions

In discussing change of size of tools resulting from hardening, it is a common practice to measure a given dimension at a certain location. However, if a given dimension is measured at a number of locations, variations of appreciable magnitude will be found. For example, holes in dies may become "hour-glass" in shape, or may "belly" in the interior. Thus the recorded diameter of the hole will depend upon where the hole is measured. For the utmost in precision it is necessary to measure all basic dimensions in a number of locations. Measurement of a few dimensions may not give a true picture of distortion resulting from the hardening operation.

e. Rehardening of Tools

Tools are often rehardened by first annealing the hardened tool, followed by re-quenching and re-tempering. Distortion in the original hardening operation which resulted from inherent distortion will be removed by the anneal, but the distortion resulting from warpage will not be removed and will re-occur a second time in the second hardening operation. Thus, a tool which shrank .010" on one dimension as a result of the warpage factor associated with its size and shape will shrink the same amount on the second treatment, making total shrinkage in two treatments of .020".

Table IV—Volume Changes in Tempering Tool Steel at 400°F.

Grade of Steel	Specific Gravity, Annealed	Specific Gravity, Hardened*	Specific Gravity, Hardened and Tempered	% Volume Change in Hardening	% Volume Change in Hardening and Tempering
Carbon Tool Steel (⅜" dia. x 1⅛")	7.865	7.795	7.805	+.9%	+.8%
Mn Oil Hardening	7.853	7.805	7.818	+.6%	+.45%
Si Mn Shock Resisting	7.770	7.725	7.730	+.6%	+.5%
Air Hardening (5% Cr)	7.815	7.795	7.800	+.3%	+.2%

*Hardening treatment given in Table I. (See July-August issue)

At this point in our discussion, it should be obvious that there is no tool steel which can be hardened without distortion, despite the amounts of so-called "non-deforming" and "non-distorting" steels which have been sold and used. Since there is a volume change which accompanies the hardening operation, it is fundamental that there must be dimension changes. Occasionally certain tools will be heat treated with "negligible" distortion and the assumption will be made that the particular grade of steel used is "free from distortion." However, if a tool of the same grade but of different size and shape is made up, the freedom from distortion will no longer be found.

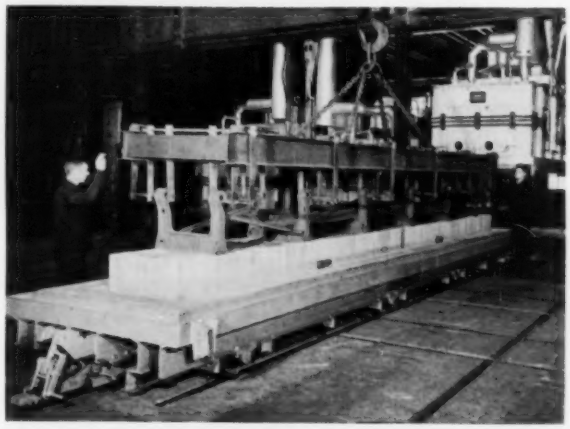
A commonly used distortion test piece is a cylindrical specimen of small diameter and length. As previously mentioned, it is possible to determine the dimensions of a cylindrical specimen which will not change length at all during heat treatment. Thus, cylindrical specimens, depending upon the dimensions chosen, may give a very optimistic viewpoint on the freedom from distortion of a given steel. If this information is used in connection with pieces of dimensions similar to those of the test piece, it will be very helpful in predicting and controlling distortion; if the information is applied to pieces of different size and shape than the test piece, it will be misleading.

Although there are no non-distorting steels in the quantitative sense of the word, it is possible on one grade of tool steel, high-carbon high-chromium, to obtain zero distortion on at least one dimension of a tool by proper control of the heat treatment operation. The method of control involves balancing shrinkage produced by austenite formation against expansion produced by martensite formation and is performed as follows:

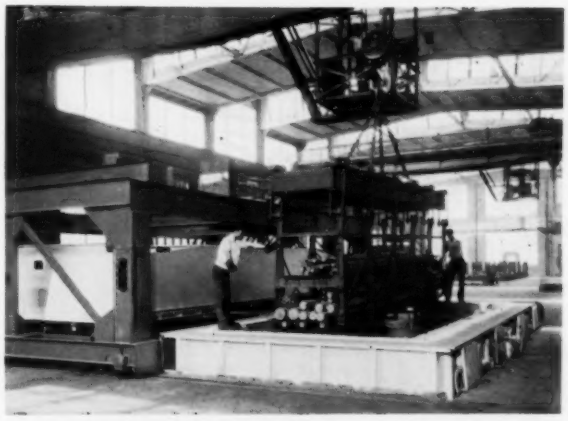
1. Heat the steel to 1850°F, hold at heat (1 to 3 hrs.) for carbide solution.
2. Air cool (quench) to 150°F or less. Normally, tools are tempered immediately upon reaching 150°F, but on most tools made of this type of steel, it is safe to cool to room temperature.
3. Measurement of the tools will show that external dimensions have contracted approximately .0005" per inch as a result of austenite retained in the quench (air cool).
4. Temper at 920°F and air cool. In some instances the temper will cause some of the austenite to transform to martensite, and the expansion resulting from the formation of martensite will neutralize the original shrinkage produced in the quench.
5. If the 920°F temper does not completely neutralize the shrinkage, the tools are retempered at 930°F to produce the desired expansion, or successively at 940°F, or 950°F, or even higher, if required. If the tempering increment is properly chosen, it is possible to bring at least one dimension, and usually more, back exactly to zero size change.

It is not possible to specify a more definite tempering procedure because the tempering temperature re-

The size and scope of the functions of the Heat Treating Department of the Bethlehem Steel Co. are clearly indicated by these pictures of operations being performed in the plant.



Electrically heated bell furnaces, used in the heat treatment of bars, Bethlehem plant, Bethlehem Steel Company.



Loading a pit furnace in the electrical heat-treatment department, Bethlehem plant, Bethlehem Steel Company.

Continuous tempering operation in rotary electric furnace.

quired to produce the desired amount of martensitic expansion depends upon the exact austenitizing conditions used in heating for the quench. The temperature attained by the tools (not by the thermocouple) and the time the tools are at heat (not the time the thermocouple is at heat) directly control the amount of austenite retained in the quench. The temperature attained by the tools and the time they are at heat will depend upon the amount of steel charged in the furnace, the thermal "head" or heating capacity of the furnace, the atmosphere in the furnace, etc., so that the exact austenitizing procedure to be used in this method must be developed with the equipment to be used in production heat treating. A heat treater who is familiar with his equipment and this type of steel will rarely require more than two tempers to accomplish the desired end. This method of controlling size change has been in practical use for about ten years.

Following are some additional notes of interest in connection with this method:

1. If shrinkage is not produced in the quench, it usually will be impossible to correct the size changes by tempering.
2. At the point where zero size change is obtained peak hardness of approximately Rockwell C60 is obtained.
3. High tempering temperatures should not be used on the first temper. If conditions were such that a 920°F or 930°F draw would have sufficed, the higher temper will produce expansion beyond that desired so that the piece is permanently expanded. The high temper will also cause loss of peak hardness.
4. If an excessively high quenching temperature or an unusually long hold at temperature is employed, an unusually large amount of austenite will be retained in the quench. This may require the use of unusually high tempering temperatures (as high as 1050°F) in order to obtain the desired expansion.
5. For maximum toughness and resistance to grinding checks, it is advisable to double temper, the second temper being at 900°F, or 25° lower than the temperature used for martensite transformation.

There is one other characteristic of high-carbon high-chromium steel regarding distortion which must be mentioned. As pointed out by Scott and Gray[2], the distortion of this type of steel in the longitudinal direction with respect to hot work, is about twice as great as in the transverse direction. It is for this reason that dies, where exact thickness is unimportant, are cut from the bar stock so that the thickness is in the longitudinal direction if this is consistent with the direction selected on the basis of intended working stresses. While the size change in hardening with respect to the longitudinal direction can be controlled by the austenite-martensite balance method, for precision work it is necessary to recognize the difference in movement of this steel in longitudinal and transverse directions. Generally, a higher austenitizing temperature than 1850°F is required, in order to obtain the initial shrinkage in the longitudinal direction. This shrinkage can be neutralized in exactly the same manner as outlined previously. However, when zero size change is obtained in the longitudinal direction, the transverse dimensions will usually show some contraction.

Summary

The practical control of distortion of tool steel in the hardening operation can be carried out as follows:

A. Tools on which little or no metal is to be removed by grinding after hardening.

Tools in this class require the use of a good controlled atmosphere furnace to avoid scaling and soft skin (decarburization) which would otherwise require removal.

1. Use high-carbon high-chromium tool steel and heat treat for zero size change on the critical dimensions by the austenite-martensite balance method described in the text. A small amount of grinding may be required on the less critical dimensions, if it is desired to bring all dimensions back to zero size change.
2. Use an air hardening tool steel, such as the 5% Cr type of steel, allowing for the expected expansion which will occur in the hardening operation. The usual allowance for this type of steel is .001″ per inch, but a more accurate allowance is .0007″ per inch.
3. The required accuracy cannot ordinarily be obtained with oil or water quenching steels, except on the basis of previous experience with tools of the same size and shape.

B. Tools on which an allowance for grinding must be made in order to remove surface scale and soft skin.

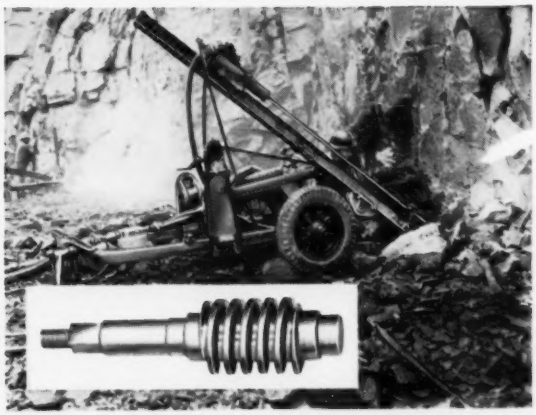
Tools which are heat treated in furnaces not equipped with atmosphere control will develop a certain amount of scale and soft skin (or decarburization) which must be removed by grinding to produce satisfactory working surfaces. While this grinding operation is being carried out, it is a simple matter to do a small additional amount of grinding to produce the desired dimensions.

1. When using air hardening steels, the methods outlined in A1 and A2 will provide more precision than is actually needed for proper control.
2. When using oil hardening steels, in sections which will harden through, the proper allowances can be made on the basis of inherent distortion "factors." The allowance for Mn oil hardening steel is .0015″ per inch, and approximately .002″ per inch for other oil hardening steels.
3. When using water hardening steels, or oil hardening steels in sections which do not harden through, proper allowances for distortion in hardening can only be made on the basis of previous experience with tools of the same size and shape.

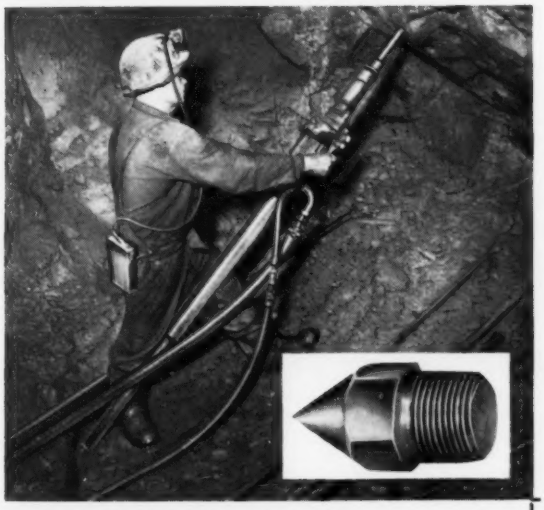
2. Howard Scott and T. H. Gray, "Dimensional Changes on Hardening High Chromium Tool Steels," Transactions, American Society for Metals, Vol. 29, 1941, Page 503.

INGERSOLL-RAND SAVES MONEY

by using AEROCASE® 510 Case Hardening Compound



Steep angle toe-hole drilling with the FM-3 Wagon Drill. Inset, yoke hoist worm.



Ingersoll-Rand's R-58 Stopehamer. Inset, tail-piece.

1 AEROCASE 510, together with AEROCASE 28, is used for carburizing and hardening the yoke hoist worm of Ingersoll-Rand's FM-3 Wagon Drill. This SAE 1020 worm gear—finish machined prior to salt bath treatment—is carburized at 1500° F. for about 1 hour, oil quenched, to secure a case depth of more than 0.005".

2 AEROCASE 510 helps to harden a previously carburized "tail-piece" for the Ingersoll-Rand R-58 Stopehamer. The SAE 1074 "tail-piece" is brought up to 1575° F. in an AEROCASE 510 bath, and then oil quenched. The point of the "tail-piece" is heated in a lead bath to 1420° F., then brine quenched and tempered at 400° F. for two hours; final specification: point, 61-62 Rockwell C; body, 50-52 Rockwell C.

3 AEROCASE 510 is also used as a cover for the lead bath. It prevents the lead from oxidizing and also wets the part being treated, to prevent lead from sticking to it. This lead bath gives a very fast temperature penetration in a limited area, confining hardness to the tip of the tail-piece and preventing embrittlement of the body.

This three-way use of AEROCASE saves Ingersoll-Rand money by simplifying their raw materials requirements. It is another example of how Cyanamid heat treating compounds can help you meet high specifications for civilian and defense contracts, so... *Next time call Cyanamid first.*

Cyanamid's heat treating compounds include:

AEROCARB® Carburizing Compounds

AEROCASE® Case Hardening Compounds

AEROHEAT® Heat Treating Compounds

In Canada: North American Cyanamid Limited, Toronto and Montreal

MT9

AMERICAN Cyanamid COMPANY

INDUSTRIAL CHEMICALS DIVISION

30 Rockefeller Plaza, New York 20, New York

- ☐ Please send me technical data on AEROCASE Case Hardening Compounds
- ☐ Please have technical service representative call.

*Name*_____ *Position*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

News to Heat Treaters...

Editor's Note: This is a new department intended to provide news items to heat treaters everywhere. Be sure to send us *your* news items.

Allis-Chalmers Releases New Induction Heating Film

A few of the thousands of uses to which induction heat is being put by industry today are shown in a new 16 mm sound film in color released by Allis-Chalmers Manufacturing Company.

Production scenes photographed are varied. They include heating of steel strip for baby buggy springs, annealing of automobile brake arms, brazing fittings into refrigerator compressor housings, and hardening eight localized areas of a rocker arm shaft.

These samples showing the use of induction heating in industry help to emphasize the effectiveness and speed of the method and demonstrate its versatility possible through the use of different work fixtures. A brief visual explanation of how induction heating operates is included in the film.

Running time of "Induction Heat" is 20 minutes. Prints of the film are available for group showing upon request from Allis-Chalmers Manufacturing Company, Advertising and Industrial Press Department, General Machinery Division, Milwaukee 1, Wisconsin.

* * * *

DR. RAYMOND C. MACHLER

Appointment of DR. RAYMOND C. MACHLER, 3033 Queen Lane, Germantown, Pa., as Director of Research and a member of the Executive Committee of Leeds & Northrup Company, Philadelphia, manufacturers of electrical measuring instruments, automatic controls, and heat-treating furnaces, has been announced by Charles S. Redding, president of the company. Dr. Machler, formerly Associate Director of Research, succeeds I. Melville Stein, who recently was elected to the newly created post of Executive Vice President.

A native of Evanston, Ill., Dr. Machler is a graduate of Northwestern University, where he received the degrees of Bachelor of Science, Master of Arts, and Doctor of Philosophy. He joined Leeds & Northrup in 1929 as a research engineer and physicist and became Associate Director of Research in 1948.

Dr. Machler is well known for his contributions to the fields of optical and pyrometric measurements, and has authored papers on the subject in scientific journals.

He is a member of Sigma Xi, Phi Beta Kappa, American Physical Society, Optical Society of America, American Society for Testing Materials, Physics Club of Philadelphia, the Franklin Institute, Society for Applied Spectroscopy, American Association for the Advancement of Science, American Institute of Electrical Engineers, and American Ordnance Association.

At the same time, Redding announced that J. C. Peters, Associate Director of Research, will be joined in that capacity by G. A. Perley and A. J. Williams, Jr. Both formerly were Assistants to the Director in the company's Research Department.

* * * *

V. H. Ferguson Heads New Corporation

V. H. FERGUSON has been elected president of the newly formed Ferguson Equipment Corporation. He resigned from the Loftus Engineering Corporation to direct the organization.

The new corporation has established executive and engineering offices at 21st and Penn Ave. and has fully equipped shops at 20th St. and Liberty Ave., Pittsburgh, Pa.

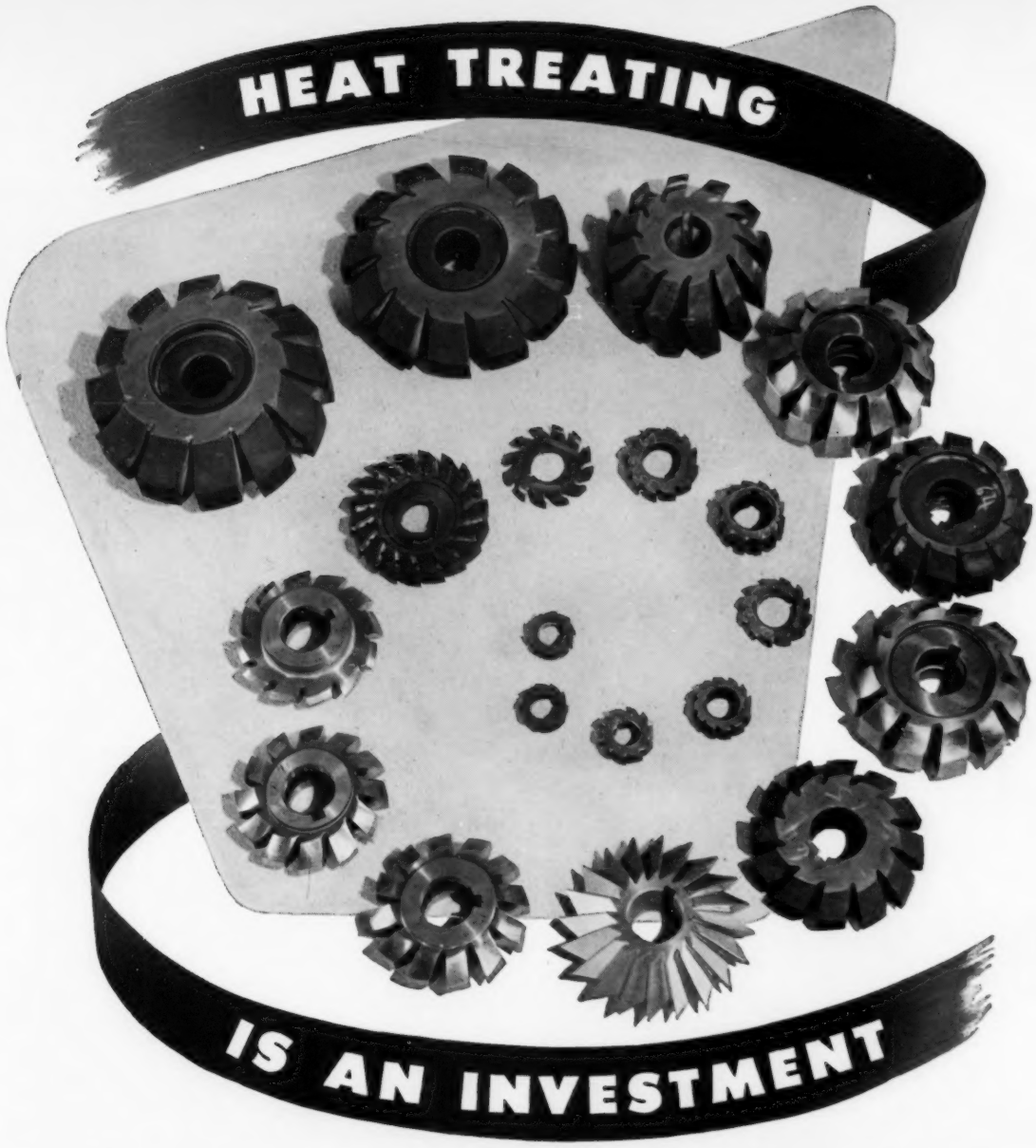
Special attention will be given to designing and building Industrial Heat Treating Furnaces and related equipment, a line of work for which Mr. Ferguson is well known in the industry. Prior to his engineering service with Loftus, Mr. Ferguson was connected with Westinghouse Electric. The new Corporation has already been awarded several important contracts. Representatives have been established in principal cities.

* * * *

Frank M. Aldridge, President and Principal Owner of the J. W. Kelley Company, 3401 West 140th Street, Cleveland 11, Ohio, announces that the name of his company has been changed to Aldridge Industrial Oils, Inc.

The J. W. Kelley Company has been producing special lubricants, cutting, grinding, and quenching oils, drawing compounds, and heat treating products for over a quarter of a century.

Aldridge Industrial Oils, Inc., with the same experienced personnel and at the same location, will continue to provide the same quality products as in the past.



Depending on the shop that is doing it, HEAT TREATING can be just "another job" . . . OR, A REAL INVESTMENT!

These cutting tools, for example, represent top-grade tool steel, plus many skilled man-hours . . . they cost real money. The heat treating means only a few cents more by comparison. But in those few cents can be represented many hours of dependable tool service, or the failure of the tool after only a short period of use.

Here at Lansdale we consider every job as an investment. We put everything that we have in the way of modern knowledge, experience and equipment into *every* job regardless of size or quantity. The result—a constantly growing list of satisfied customers.

Call us at LANSDALE (PA.) 4611 for a quotation on your work.

REX

J. W. REX CO. *Successors to REX & ERB*

Consultants and Specialists on Modern Heat Treatment

Plant and Laboratory LANSDALE, PA. Phone: Lansdale 4611

Institute News . . .

The Annual Meeting of the Metal Treating Institute is being held October 12-14, 1951 in the Detroit Leland Hotel, Detroit, Michigan. A large turn-out is expected. A tentative outline of the program follows:

FRIDAY—October 12—A.M.

Registration
President's Welcome
Minutes of Spring Meeting
Speaker—Subject "Taxation" (Chas. Sligh—Natl. Assn. Mfrs.)
General Business Meeting

FRIDAY—P.M.

Member Plant Visitation
Meeting Board of Trustees

SATURDAY—October 13—A.M.

Report Publication Committee and Report and Recommendations of Board of Trustees and Discussion
Motion Picture

SATURDAY—P.M.

Banquet and Party

SUNDAY—October 14—A.M.

Presentation of Motions and Voting on all previous Recommendations
Election of Officers and Installation

SUNDAY—P.M.

New Board and Executive Meeting

* * * *

President Walter Rex shortly after the Eastern Regional meeting appointed an "Apprentice Program Committee" made up of the following members:

A. M. Cox, Chairman	Fred Heinzelman, Jr.
L. S. Miel	George Harris
Horace Knerr	William E. Bohn

On Friday, September 7, a meeting of the Committee was called and held in the offices of John E. Kenney, Regional Director, U. S. Department of Labor, Bureau of Apprenticeship, Philadelphia, Pa.

At this meeting tentative standards of apprenticeship for the heat treating industry were drawn up for submission to the National Department of Labor in Washington and to the Regional Bureaus of Apprenticeship which have been established in various states.

With the acceptance and establishment of these standards commercial heat treating plants will have a duly recognized apprenticeship program which will be of real value to them in helping solve manpower shortages and the status of the occupation in general.

* * * *

Cook Heat Treating Corporation, Los Angeles, has completed the installation of an Ipsen Universal Heating and Quenching unit. The furnace is equipped with instruments controlling accurately dew point, composition and rate of flow of atmosphere gas, temperature, time at temperature in the heating unit and temperature and rate of flow of quenching oil. Capacity ranges from 75 pounds to 250 pounds per hour depending on heating requirements and density. Temperature range is from 1400°F to 1700°F.

MTI MEMBERS SURVEYED TO AID NPA

Editor's Note: As suggested by National Production Authority officials a survey of MTI members to secure their estimates of future needs for nickel alloyed equipment was made and the information passed along to the proper office in Washington recently. The results of the survey and the information compiled are shown below:

August 2, 1951

Mr. Ernest Hergenroether, Assistant Director
Iron and Steel Division
National Production Authority
Washington, D. C.

Dear Mr. Hergenroether:

During the last week in May of this year a meeting of the membership of the Metal Treating Institute was addressed by Mr. Thomas J. Fitzgerald, Regional Head of Priorities and Allocations, National Production Authority, Denver, Colorado. During the course of this meeting the subject of the procurement of nickel alloy components and production parts by the Heat Treating Industry was naturally discussed. At that time it was suggested by Mr. Fitzgerald and agreed that a survey of members of the Metal Treating Institute would be taken to ascertain their estimates for the third and fourth quarters of the amount of nickel alloyed equipment they would require along with their knowledge of the actual pound content of nickel contained in such equipment.

In addition in making this survey we also secured from them the information as to whether or not these companies were returning nickel scrap to foundries or other sources of supply for remelting. We also secured their estimate of the amount of nickel scrap which would be returnable during the third and fourth quarters.

The totals established by twenty companies and the results are tabulated below:

ESTIMATED REQUIREMENTS NICKEL ALLOYED EQUIPMENT

3rd Quarter		4th Quarter			
NI Alloyed Equipment Required lb.	Estimated Nickel Content lb.	NI Alloyed Equipment Required lb.	Estimated Nickel Content lb.	3rd and 4th Quarter Returnable Scrap—lb.	Returning Nickel Scrap
67,634	26,779	62,142	25,127	61,500	5—No 15—Yes

These figures are sent to you purely in the hope that they may be helpful by providing concrete evidence of the scope of the heat treating industry as a nickel alloyed consumer.

As the trade association of the commercial heat treating industry, this organization, with its 66 member companies, stands ready to provide their full cooperation in any way that might prove helpful.

Sincerely yours,
METAL TREATING INSTITUTE
C. E. Herington
Executive Secretary

(Continued on page 14)

Expert HEAT TREATING

FOR SPECIAL JOBS OR PRODUCTION RUNS

The House That Heat Built

YOUR TIME and MONEY are PROTECTED at COMMERCIAL STEEL TREATING

The parts you send for heat treating represent your investments of time and money. We appreciate how important it is to you that they be protected by perfect heat treating. Your protection lies in our skilled personnel—top craftsmen who contribute decades of experience to your job—and our complete range of all types of modern equipment.

CALL ON US FOR ADVICE. Our metallurgical engineers are well qualified to help solve your metal-treating problems and we will welcome your inquiries.

Pick-up and delivery service 24 hours a day

Complete Service

- ★ Bright Hardening of stainless steels
- ★ Steam Treating high-speed cutting tools
- ★ Carbo-nitriding
- ★ Carburizing—Liquid, Gas, Pack
- ★ Martempering
- ★ Nitriding
- ★ Austempering
- ★ Salt Bath Hardening
- ★ Cyaniding
- ★ Chapmanizing
- ★ Normalizing
- ★ Atmosphere Control Hardening
- ★ Annealing
- ★ Shrinking
- ★ Seasoning and Aging
- ★ Stress Relieving
- ★ Special Treating
- ★ Deep Freezing
- ★ Silcoting
- ★ Gleason Machine Quenching
- ★ Straightening
- ★ Sandblasting
- ★ Plasmo (special hardening of special dies and hobs)
- ★ Gritblasting
- ★ Liquid Surface Honing
- ★ Malcomizing (for surface hardening stainless steels)
- ★ Kaliding (increases life of finished high-speed steel tools)
- ★ Soditing (for toughening finished high-speed steel tools)

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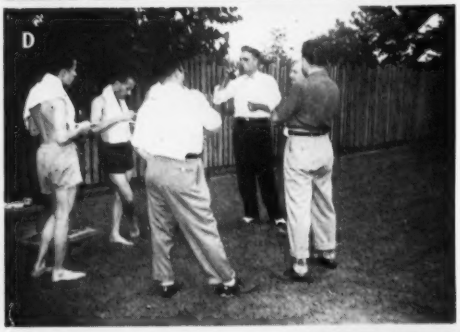
EASTERN REGIONAL MEETING and *President's Day* August 3, 1951

On these pages is presented a quick photographic story of the Eastern Regional Meeting and outing held in Philadelphia and Lansdale, Pa., on August 3, 1951. These pictures, as pictures always do, reveal better than could many words, a few of the basic values of a trade association.

In meetings of this type, men having the same interests and faced with the same problems in the same type of business are able to get to know each other and help each other through discussion, fellowship and better understanding.

Gathering at the plant of the Budd Company in Philadelphia at 10 A.M., the group was provided an escorted trip through this large manufacturing unit and saw with real interest the body-part stamping and forming operations. In the Metallurgical Laboratory Chief Metallurgist Joe Winlock talked interestingly about the properties of various automotive body steels as well as the various types of metals used for the many thousands of dies, large and small, needed for their production.

On schedule the group piled into automobiles (there were plenty on hand) and headed for the Metlab plant on the outskirts of Philadelphia. From there the cameraman (thanks to Horace Knerr) provides most of the rest of the story.



THE PHOTO NEW

A After visiting The Budd Company plant, group arrives at grounds of Metlab Company in tow of smiling Secretary Herington and—

B renews old friendships,

C gets a load of quick refreshment via past president Horace Knerr and—

D well, what is this, a swimming party, strip tease or

E a soft ball game?

F Now I'm all mixed up with two guys playing quoits near

G the Mermaid Pool (only they're Stags today).

H What a gang! But they've settled down at last,

I to more solid (?) refreshment

J and then pay some attention to the speaker of the occasion (subject—Renegotiation).

S REPORTER SAYS:

K After that, they still had strength to wander through the Metlab plant

L talk some more "shop" and

M see that 12 foot vertical quench.

N Now President Walter Rex takes over, gathers the gang together and

O they depart for Rex's plant and farm, where it was too late for photographs but just in time for various refreshments and a marvelous Clam Bake. Heard some interesting suggestions and ideas from the Philadelphia Department of Labor Regional Director about the establishment of a standardized apprenticeship course in commercial heat treating plants.

After tour of J. W. Rex Company everyone went to Walter Rex's Anodizing plant. One of his technicians provided an interesting, practical talk on the application of anodizing treatments to various metals.

What a day!

P.S. If you were there, pick out your own mug. If you were absent, tough luck.

EASTERN REGIONAL MEETING and *President's Day* August 3, 1951

A typical MTI Outing which Combines:

Good Fellowship, Recreation, Plant Visits, Technical Sessions, Exchange of Ideas.

Those who were with us:

ANDERSON STEEL TREATING CO.
Detroit, Mich. — *Carl G. Anderson, Gus Anderson*

B-M HEAT TREATING CO.
Newark, N. J. — *Harvey L. Miller*

BENNETT STEEL TREATING CO.
Newark, N. J. — *Mel Dressen, J. Melnik*

COMMERCIAL METAL TREATING, INC.
Bridgeport, Conn. — *Michael Kober*

FERROTHERM CO.
Cleveland, Ohio — *Joseph Christ, John P. Gier, Jr.*

FRED HEINZELMAN & SONS CO.
New York, N. Y. — *Fred Heinzelman, Jr., Fred Heinzelman, Sr.*

L-R HEAT TREATING CO.
Newark, N. J. — *Domenick Monaco, Frank Rizzo*

LAKESIDE STEEL IMPROVEMENT CO.
Cleveland, Ohio — *Robert Derhammer*

METAL TREATING INSTITUTE
New Rochelle, N. Y. — *C. E. Herington, Executive Secretary*

METLAB COMPANY
Chestnut Hill, Pa. — *Barry Knerr, Conrad H. Knerr, Horace C. Knerr, F. S. Smyth*

METRO HEAT TREAT CORP.
New York, N. Y. — *D. M. Knoch*

NEW ENGLAND METALLURGICAL CORP.
South Boston, Mass. — *Fred Whipple*

PAULO PRODUCTS CO.
St. Louis, Mo. — *Frank Rassieur*

PITTSBURGH COMMERCIAL HEAT TREATING CO.
Pittsburgh, Pa. — *Al Cox, Robert Brocker*

J. WALTER REX CO.
Lansdale, Pa. — *J. Hawley, J. W. Rex, J. Walsh*

WEIDEMANN MACHINE CO.
Philadelphia, Pa. — *Joseph H. Bockrath*

ROBERT WOOLER
Dresher, Pa. — *Phil Keidel*

(Continued on page 24)

Manufacturers' Literature . . .

The literature listed below contains information of interest to heat treating organizations. For your copy write direct to the manufacturer and be sure you mention seeing it reviewed in "Metal Treating."

Heat and Flame Resistant Gloves

The C. Walker Jones Co., Philadelphia, 38, Pa., has published a well illustrated bulletin describing a line of work gloves, hand pads and guards, designed to protect workers' hands. Gloves are interchangeable and are available in various styles and shapes.

Water Soluble Carburizing Materials

American Cyanamid Company, New York 20, N. Y., has a four-page technical data bulletin describing the uses and properties of Aerocard Carburizing Compounds E and W. The booklet includes charts showing depth of case achieved and also the carbon and nitrogen gradients of the case composition when compounds are used on SAE 1020 steel.

Industrial Gas Appliances

Johnson Gas Appliance Co., Cedar Rapids, Iowa, publish a 24-page catalog of their complete line of gas burning equipment. The catalog illustrates dozens of items of interest to heat treating operators. It also contains a complete index and price list. Ask for Catalog No. 51-30.

Portable Hardness Tester

Newage International, Inc., New York 17, N. Y., national distributors of the Ernst Portable Metal Hardness Tester, has a four-page booklet describing this unit. The tester is used by pressing hand grips for immediate direct readings. Models providing either Brinell or Rockwell readings are available.

Solenoid Cam Type Oil Valves

Hauck Manufacturing Co., Brooklyn 15, N. Y., has just issued their Catalog 710 describing shut-off valves for controlling oil flow for both light and heavy grades for temperatures up to 250°F. Details of the special rotating cam and valve operation are described and illustrated.

Tool Steel Selector

Crucible Steel Company of America, New York 17, N. Y., has available a dial-type tool steel selector which is designed to assist in the selection of the right tool steel in order to provide specific characteristics, and also quickly presents the proper heat treatment for various grades. Valuable to heat treaters working with the various 22 tool steels, dies, molds, and alloys included on the chart.

Heat Treating Pots

American Brake Shoe Co., Electro Alloys Division, Elyria, Ohio has published a new bulletin T-205 describing more than 100 patterns available for Thermalloy heat treating pots. All pots are pressure tested and X-rayed.

Safety Control in Induction Heating

Lindberg Engineering Co., Chicago 12, Illinois offers Bulletin 1440 providing details on the "Checklite" system for safety control during induction heating production.

Furnace Heat Prover

Cities Service Oil Company, New York 5, N. Y., has a booklet "Combustion Control for Industry" describing a new instrument called the "Heat Prover."

Corrosion — Causes and Prevention

A new Third Edition of "Corrosion—Causes and Prevention," by Dr. Frank Newman Speller, is available from the McGraw-Hill Book Company, New York, N. Y. Written with particular reference to the ferrous metals, this book discusses the theory of corrosion and describes the various methods for preventing it. Highlights of the new edition are its coverage of Cathodic Protection, an important new factor, and inclusion of the latest available information on biological influences and newly developed corrosion preventives. Price $10.00.

Laboratory Equipment

A new edition of "What's New for the Laboratory," No. 13 in the series, has just been issued by the Scientific Glass Apparatus Co. Inc., Bloomfield, New Jersey.

Illustrated and described are a number of new, interesting items—including a Constant Temperature Water Bath, Vertical Autoclaves, a One-Pan Balance which does not require the attachment of weights, Flexible Heating Tape, a new type spray which reduces air-borne bacteria while simultaneously eradicating odors, a portable kit for the complete routine chemical analysis of urine, an electronic temperature controller, and many other items.

Portable Pyrometers

Two portable pyrometer models are described in Bulletin PPY-1, just released by Wheelco Instruments Company, Chicago, Illinois.

Suitable for plant and laboratory, these instruments are useful where temperatures of molten aluminum, zinc, lead, tin, brass and other non-ferrous alloys must be measured before pouring; where liquid dyes and chemicals must be held to correct temperatures to assure proper consistency and where temperatures of metals in galvanizing kettles must be maintained to provide uniformity in coating etc.

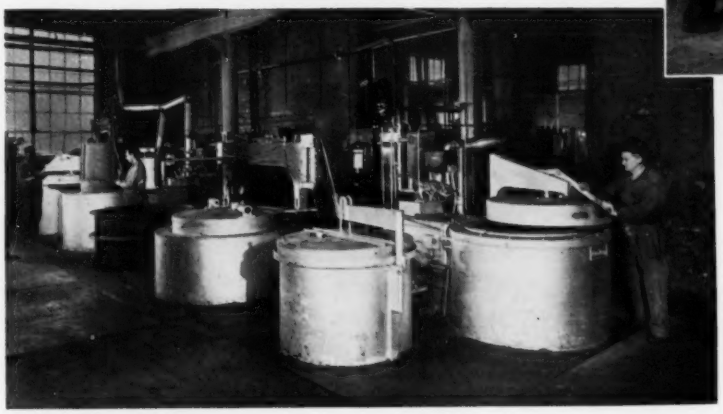
Specifications on thermocouple holders and tips are also contained in the bulletin. A separate price sheet provides a listing of standard scale ranges.

(Continued on page 23)

COMMERCIAL
Heat Treating

PRODUCTION PARTS and TOOLS

Controlled Atmosphere
Cyanide and Neutral Bath
Liquid, Gas and Pack Carburizing
Induction Heating



To assure delivery of your parts the way you want them, our equipment includes the necessary finishing units such as this Tableblast for deburring, descaling and cleaning.

Our Homo-Carb unit for precision gas carburizing and vertical pit furnaces for distortion-free treatment of heavy loads of parts, castings, forgings, etc.

Pit Type Convection
Large Car Bottom
Production Box

FURNACES FOR

Hardening
Normalizing
Annealing
Tempering

Grit and Shot Blasting . . . Carbonitriding and Bright Hardening by Endothermic Method.

COMPLETE HEAT TREATING COUNSEL WITHOUT OBLIGATION

PEARSON
INDUSTRIAL STEEL TREATING COMPANY

5757 OGDEN AVE. **CHICAGO (CICERO) 50, ILLINOIS**

Phones BISHOP 2-1757 or TOWN HALL 3-2902

THERMO-COUPLETTES . . .

Air-Fuel Ratio Controller Has Fast Response, Unit Design

An Air-Fuel Ratio Controller announced by Leeds & Northrup Co., Philadelphia, Pa., adjusts air flow to fuel flow changes rapidly, yet without cycling. Applicable to oil or gas firing, or to dual-fuel furnaces, it meters both fuel and air flow for maximum accuracy of control. Available for use where ratio control alone is desired, this instrument is a component of L&N Integrated Control of temperature, draft and combustion of large fuel-fired furnaces and kilns. Models are supplied to operate an electric or a pneumatic control valve.

Added speed and sensitivity are obtained with full stability through the use of an improved control circuit identical with that incorporated in the latest L&N temperature control systems. Wide range of proportional band and reset control actions makes it easy to adjust the control to the needs of the furnace to which it is applied.

Major sub-assemblies are standardized, readily replaceable. When used with electrically-actuated Integrated Control, both the temperature control and air-fuel ratio control utilize the same type of plug-in electronic control chassis. When air-actuated control is used, the same type of pneumatic system is built into the pyrometer and ratio controllers. Maintenance, stocking of spare parts and training of instrument men are thus simplified.

The controller comes in a single instrument case which fits into standard panel cutouts. Ratio range extends from 50% deficiency to 100% excess air. Direct remote control of air flow, and transfer from manual to automatic control are provided on the front of the instrument.

Cold-Heading Dies and How to Heat-Treat 'Em

We're finding that quite a few folks are not posted on the right way to heat-treat cold-heading dies. The hardening procedure is a lot different than you'd use on most dies made from carbon tool steel. Cold-heading steel has a carbon range from 0.90 to 1.00 pct; sizes larger than 2 in. are deep-hardening to insure plenty of chill depth for the larger sizes of headers and solid dies.

Harden at 1575° to 1625°F

Carbon tool steel having 0.90 to 1.00 pct carbon would normally be hardened about 1450°F. But a higher temperature is required for best results in cold-heading dies . . . 1575 to 1625°F.

Holding Time is Doubled

The holding time at the hardening temperature—even though the higher temperature is employed—should be just about double the usual length of time . . . the actual time for a particular die depending, of course, on the greatest thickness of the piece. Some grain-coarsening results from this treatment. This also increases the depth of chill which will be obtained on the surface of the die after the quench.

Hardness Should Decrease Gradually

A mechanical advantage also results from the procedure outlined—there is a more gradual decrease in hardness from the working surface of the die to the core. The usual sharp line of demarcation in hardness is less abrupt, and extends more gradually from chill to inner soft core. This more gradual decrease in hardness towards the center of the die is of great importance in avoiding cracking after the die is in service. This characteristic makes it possible to transmit the blow more uniformly from the hard working surface to the tough core.

Avoiding Quenching Cracks

It's often risky to use the higher hardening temperature when there are sharp corners or irregular sections on the die. In such cases, more normal hardening temperatures must be used. (1450 to 1500°F)

Watch Your Quenching

Solid dies are quenched most effectively in a fixture. A header with a deep cavity should be quenched in a fixture so that all gases are forced out of the cavity, resulting in a uniform quench of all surface points. It is necessary to quench only the working face of the die. Hardness of surfaces other than the working fact of the die adds *nothing* to die life. In fact, keeping them soft and avoiding hardening adds materially to the shock-resistance.

Temper from 300° to 400°F

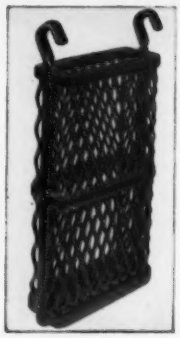
It's usually best to remove the die from the quench after the die has cooled to about 150 to 200°F . . . follow by immediate tempering at 300 to 400°F. This produces a hardness ranging from Rockwell C 59 to 61. This hardness gives the best all-around service, although higher and lower hardnesses may be better for special cases.

Polishing Adds to Die Life

Cold-heading dies give better performance when they are polished or fine-ground on the working surfaces. It's a minor operation, but an important one.

From "Tool Steel Topics" Bethlehem Steel Co.

Improved Scrap Anode Basket



An improved heavy duty Scrap Anode Basket designed to give longer service has been developed by the Belke Manufacturing Company, 947 N. Cicero Ave., Chicago 51, Ill.

The Anode Baskets are constructed of heavy gauge expanded steel welded to frame of 3/16 x 1" steel members. Bands on sides and bottom of basket and hooks are of one continuous 3/16 x 1" steel piece to give maximum strength to frame.

Extra heavy coating of Belke Universal Plastic provides positive protection from sharp anode scraps and rough handling, and withstands all plating solutions.

All Belke Scrap Anode Baskets are made to specified dimensions, and Filter Bags can be furnished for baskets of any size.

Complete information furnished on request to manufacturers.

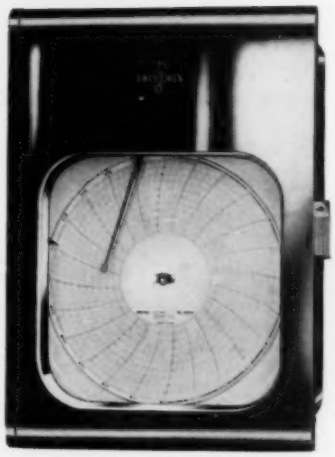
Time Saved Tempering Small Parts

National Lock Company, of Rockford, Illinois, uses six dense load Leeds & Northrup Homo Tempering furnaces to treat a large variety of washers, small Sems screws, connecting rod bolts and hardware items.

Load of hardware entering Homo dense load type Tempering Furnace at plant of the National Lock Co., Rockford, Ill.

With these furnaces in the production line, National Lock estimates they have cut tempering time substantially and still have the product meet all specifications. Work treated in the dense load Homo is tempered uniformly throughout, regardless of the load size. The furnace's turbine type fan circulates heated air at high velocity throughout the entire load quickly and uniformly. The wide, relatively shallow work basket helps each part to receive the same treatment. Thus, all production comes from the furnace with identical physical properties . . . whether taken from the top, middle or bottom of the basket. Parts can be given any structure ranging from dead soft to file hard. Results can be predicted and duplicated at will. The chart from the furnace's recording-controller is a permanent record of the treatment.

Bristol Announces New Running-Time Recorder



A new line of Running-Time Recorders has just been announced by The Bristol Company, Waterbury 20, Conn. Bristol Running-Time Recorders record on a chart the operating or "on" time of production machinery and other similar equipment. The chart record gives the total "on" time in hours, minutes, and seconds for a given period. "Time off" periods are also shown on the chart as well as the time at which they occurred. The Running-Time Recorder magnifies the running-time readings in such a way that the total operating time of a machine can be easily and accurately determined to within a few seconds. Running-Time Recorders are furnished in models suitable for wall, flush-panel or portable use. Complete information on models, ranges, specifications, and uses is given in Bulletin OP1504, which is available from The Bristol Company.

Pocket-Size Hardness Tester

A light-weight, low-cost, precision-made hardness tester has been perfected by the A. H. Company of Brighton, Michigan.

This new equipment is a radical departure from testers now in use. Approximately the size of a slide rule (8¾" x 1½" x ½"), the A. H. Tester can be conveniently available wherever accurate comparative checking or quality control is desired.

A simple hammer with non-elastic carboloy tip is allowed to drop a determined distance to rebound to reading position. Conversion charts accompany the A. H. Tester so that comparative Rockwell or Brinnell readings can be quickly obtained. The tester can also be used on the line or in quality spot-checks for comparative Go and No Go testing where desired.

LETTERS TO THE EDITOR

Dear Editor:

We received the copy of the July-August issue of Metal Treating which you sent us. In our opinion the presentation of the first part of our article on "Distortion" has been made in a very attractive and readable manner.

We appreciate your thanks for the article and can only say that we are glad to help in the educational work you are doing in the subject of heat treatment.

With regard to reprints of the article, we would definitely like to have some. Our Publications Department will advise you as to what is desired in this connection.

J. Y. RIEDEL
Tool Steel Engineer
Bethlehem Steel Company
Bethlehem, Pa.

Dear Editor:

I am in receipt of your letter and copy of the July-August issue of Metal Treating.

I thank you very much for sending me a copy of this, and if this article has in any way been of value to your members I am amply repaid for the effort it took to get the material together.

I appreciate the way in which it was presented, and am sure that it will be well received. Again thanking you for your big assist in this publication, I am

NORMAN F. TISDALE
Manager of Sales
Molybdenum Corporation of America
Pittsburgh, Pa.

Dear Editor:

Thank you very kindly for your letter of August 29 enclosing a copy of Metal Treating in which our article on hydrogen appears.

If it is convenient for you to do so, please prepare five hundred (500) reprints of this article for us and notify us of the charges. We are very much pleased with your presentation.

C. A. ZAPFFE
Metallurgist
6410 Murray Hill Road
Baltimore 12, Md.

Dear Editor:

This office would very much appreciate being placed on your mailing list to receive "Metal Treating."

ERIC A. TIETZ, Chief
Special Projects Section
Department of Commerce
Washington 25, D. C.

Dear Editor:

I am employed by the above named firm as Heat Treat Supervisor.

I am interested in being placed on your Metal Treating Journal mailing list.

Thanking you in advance

CHARLES PFEIFER
Supervisor Heat Treat Dept.
Eclipse-Pioneer
Teterboro, New Jersey

Dear Editor:

Thank you for adding me to the list of persons receiving your bi-monthly publication.

You can be sure that I appreciate this gesture and will be looking forward to reading your magazine.

L. M. LEE
Production Engineer
Fedders-Quigan Corporation
Buffalo 7, New York

Dear Editor:

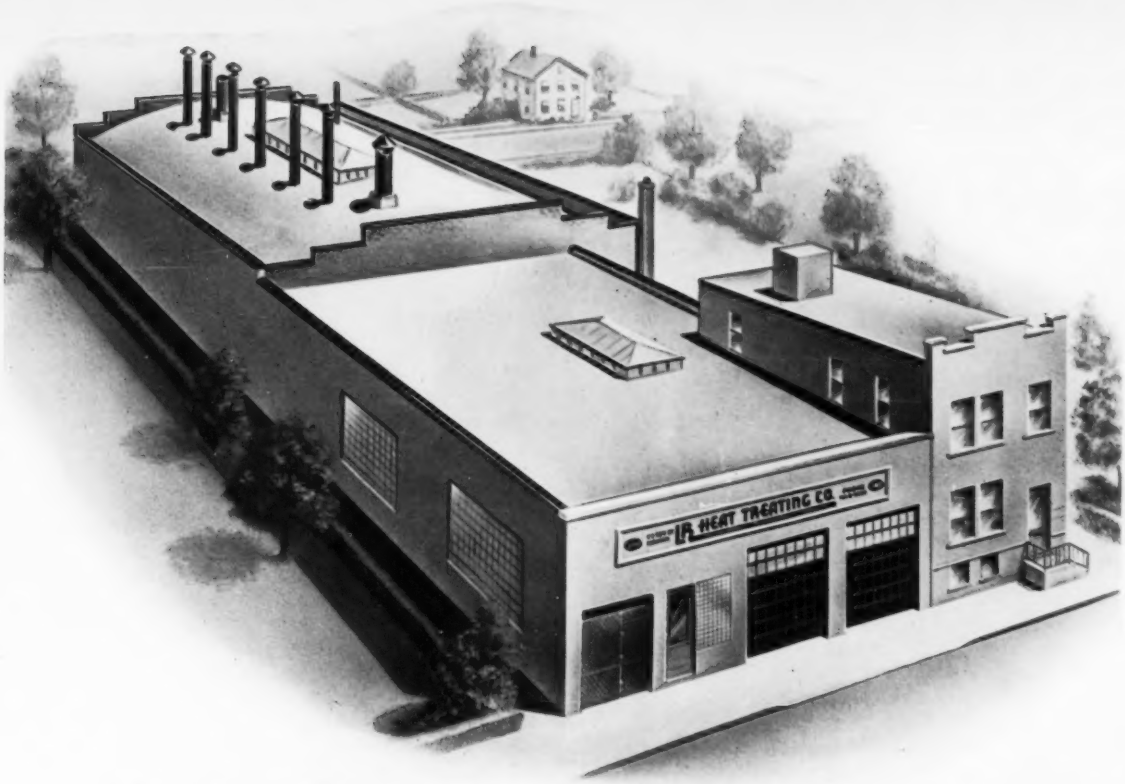
I would like to request addition of my name to your mailing list on "Metal Treating." I am a manufacturing engineer employed by Westinghouse Electric Co. and would like to keep up with new developments on heat treating, etc.

S. KANDEL
739 Yale Ave.
Swarthmore, Pa.

Dear Editor:

I have received the May-June 1951 issue of Metal Treating and would like to be put on your mailing list to receive subsequent issues.

J. D. VOSS
Metallurgical Engineer
The Bauer Bros. Co.
Springfield, Ohio



QUALITY
STEEL TREATING

Our new and modernly equipped plant, one of the largest in the East, offers complete commercial metal treating services.

THESE INCLUDE:

- **Hydrogen Annealing**
- **Carbo-Nitriding**
- **Annealing-Normalizing**
- **Cyaniding-Carburizing**
- **Furnace Brazing**
- **Induction Heating**
- **Controlled Gas Carburizing**
- **Liquid Carburizing**
- **Salt High Speed Steel Hardening**
- **Nitriding**

SPECIFICALLY EQUIPPED FOR QUANTITY PRODUCTION

L•R HEAT TREATING CO.

107 VESEY STREET **NEWARK, N. J.**

PERSONALS

Mr. John Hulting, President of Perfection Tool & Metal Heat Treating Co., Chicago, recently enjoyed a successful vacation fishing in Maine.

* * * *

Bob Davis, one of the metallurgical engineers at Perfection Tool & Metal Heat Treating, spent his vacation in and around Fort Lauderdale, Florida.

* * * *

Pearson Steel Treating Co., Chicago, has acquired a lease option on two acres of land adjacent to their plant. Tentative plans call for the ultimate use of this land for a modern heat treating plant which will be known as Pearson Metal Processing Corporation. At the present time the lot will be used for parking and storage space for the present plant.

* * * *

Ray G. Sault, President, Porter Forge & Furnace, Inc., Somerville, Mass., has just returned to his office after an annoying siege in the hospital having a 7½ inch appendix removed. Mrs. Sault went to the hospital with him just to have a general check-up and landed in the operating room having not only her appendix but gall bladder eliminated, so that both were confined in the hospital at the same time and their August vacation "went out the window."

* * * *

K. U. Jenks, Controller and Secretary of Lindberg Steel Treating Co., Chicago, has been elected to the Board of Directors of the Company. Mr. Jenks is well known to members of the MTI, always having been active and interested in the organization.

In addition at Lindberg, E. J. Pavesic has been appointed Director of Research; N. O. Kates, Works Metallurgist; F. J. Minch, Metallurgist and A. E. Uitti, Works Manager.

Production Heat Treatment of Small Caliber Ammunition

Bulletin SC-153, by Surface Combustion Corp., Toledo 1, O., describes fuel-fired batch and continuous furnaces used in the production of small caliber ammunition.

The heat treat furnace equipment required at each consecutive step in the production of a finished round of ammunition are included. Step-by-step, from raw material to finished product, the heat treat processes required for steel projectiles, steel and brass cartridge cases and cartridge belt clips and links are described in conjunction with proper furnace equipment.

The back page of this bulletin contains a handy reference table showing the relation of heat treat furnace equipment to the consecutive steps in production of small caliber ammunition.

New Pyrometer Bulletin

The Bristol Company of Waterbury 20, Conn. has just published a new bulletin, No. P1244, on its line of millivoltmeter type indicating pyrometers and pyrometer controllers for temperatures up to 4000°F. Indicating pyrometers for wall, switchboard, and flushpanel switchboard, and flush-panel mounting, and for portable use are described and illustrated. Also shown are rotary and toggle switches for use with these pyrometers where a number of temperatures in an oven, furnace, or process are to be measured with one instrument. Information is also given on automatic pyrometer controllers for use with gas, electric, and oil-fired furnaces. Full-size reproductions of indicating scales for both indicating and controlling pyrometers are included.

Today I did easily and quickly a task that floored me yesterday. I'd forgotten why I couldn't do it.—*Nuggets*

* * * *

There is no exercise better for the heart than reaching down and lifting people up. —*John Andrew Holmes*

Institute News (cont.)

WORLD METALLURGICAL CONGRESS

On Monday, September 24, about twenty representatives from friendly European nations visited the plant of Metlab Co., Philadelphia, for the purpose of observing the practice of Commercial Heat Treatment of Metals as it is done in the U. S. A.

These men are chosen by their respective nations for their qualifications as metallurgists and their knowledge of, and interest in, the subject of heat treatment.

The visit was part of a tour of industrial plants in the United States arranged by the American Society for Metals, under the direction of the U. S. Government.

After touring the Metlab plant, the delegates were entertained at luncheon by the Company at a nearby restaurant, after which they toured through Fairmount Park to the Franklin Institute where the Museum of Science and Industry was opened specially to receive them.

SOME THINGS TO LEARN

Learn to like what doesn't cost much.

Learn to like reading, conversation, music.

Learn to like plain food, plain service, plain cooking.

Learn to like fields, trees, woods, brooks, hiking, rowing, climbing hills.

Learn to like people, even though some of them may be as different from you as the Chinese.

Learn to like to work and enjoy the satisfaction of doing your job as well as it can be done.

Learn to like the songs of the birds, the companionship of dogs » »

Learn to like gardening; puttering around the house, and fixing things.

Learn to like the sunrise and sunset, the beating of rain on the roof and the windows, and the gentle fall of snow on a winter day.

Learn to keep your wants simple, and refuse to be controlled by the likes and dislikes of others.

* * * *

My idea of the real aristocrat is the master workman, no matter what his line of work may be.—*Henry L. Doherty*

New Development in Salt Baths

Eliminates scale and decarburization on steels in neutral salt baths operating up to 2300° F.

NEUTRAL hardening in molten salt baths should mean just what it says. No scale or decarburization is present in a properly rectified neutral salt, regardless of temperatures used. This is possible at 1500°F. and up to 2300°F. A recent development by one of the leading salt bath suppliers makes this possible for the first time without the manual addition of solid deoxidizers. The Neutra-Gas Process (U. S. Patent No. 2474680) is simple, effective, and inexpensive. Merely bubble an inexpensive commercial gas through the molten bath for recommended periods. Neutrality is easily checked chemically or physically. The Neutra-Gas Process is operating at the present time in molten baths weighing less than 100 pounds and those holding several tons of salt.

A truly neutral salt is the ideal medium for heating all steels with no surface effect. There is no atmosphere, and air is excluded while the work is heating. Scaling and decarburization are prevented. A thin film of salt protects parts right up to the quench. With neutral salts operating at 1500°-1600°F., Neutra-Gas is used for just a few minutes per shift. Sludging is practically eliminated; economies result because sludging removes good usable salt. The bath remains very fluid allowing rapid and uniform heating with less distortion. To obtain all the advantages of salt bath hardening, use salt baths for both heating and quenching The improved fluidity of the Neutra-Gas controlled neutral salt assists materially in isothermal quenching salt operations.

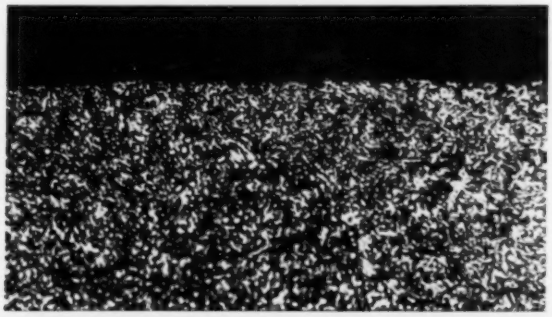
Neutral Salts from 850° — 1850°

Various salt mixtures provide a wide range of usefulness in the heat treatment of steel. The Neutra-Gas is used with chloride mixtures only. The most popular type is Park Nu-Sal Neutral Salt. Its melting point is 1230°F. with a range of 1300°-1600°F. Most steel hardening temperatures fall within this range. Nu-Sal is widely used as the austenizing bath for isothermal treatments such as austempering and martempering.

Cycle annealing involves a wider range of temperatures. Park K-3 Neutral Salt melts at 1020°F. and is usable past 1700°; periodic use up to 1850° is permitted if proper rectification is made with Neutra-Gas.

Low melting salts are available for special purposes. Park's #800 Neutral Salt (melting point 850°F.) and Park #900 Salt (melting point 920°) are used for tempering, high speed steel quenching, and have a range up to 1700°F.

Baths operating consistently at 1700° to 1900°F. usually operate with less fuming and volatilization if their melting points and top operating temperatures are slightly higher. Park K-17, with a range up to 1900°F., also has a reasonably low melting point of 1175°F. Economy is indicated here as the temperature of an idle furnace may be kept at 1250°-1300° with very low power costs.

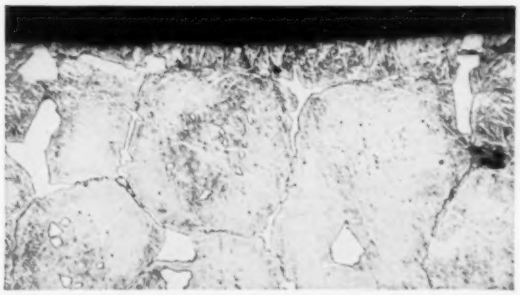


(X 500) Microphotograph of the edge structure on SAE 1095 steel treated for 60 minutes at 1450°F. in a commercial installation of Park Nu-Sal kept neutral with the Neutra-Gas process. (Sample quenched in caustic solution and tempered in No. 800 Neutral Salt at 1200°F.)

No Decarb on Moly High Speed Steels

Wider use of molybdenum high speed tool steels has virtually made the use of salt baths mandatory. During the last War it was salt baths which made possible the adoption of the molybdenum high speed steels in place of the very critical tungsten types.

As in most instances, the increased use of a method leads to rapid improvements. The improved rectification of high heat salt baths operating from 2200°-2300°F. is a development of the Park Chemical Company laboratories. The Neutra-Gas Process was adapted to the higher temperature applications in order to reduce the oxides of the chloride salts. Metallic oxides are reduced by graphite rods immersed in the salt. Costly and laborious sludging has been nearly eliminated and electrode life increased. Size loss of tools is held to a minimum. It is possible to harden unground or finished tools. Scaling, decarb, oxidation, pitting and other surface defects are automatically avoided. Distortion is negligible. Immersion in salt seals out all atmosphere. Salt film protects work right through the quench. For pieces large or small, temperature is even and constant.



X500—(Reduced in Printing) Edge structure of high speed steel after several hours in a Park No. 175 Hi-Heat salt bath.

Process detail is preheat at 1550°F. in Park No. 117 Preheat Salt, high heat at 2200°-2350°F. in Park High Heat No. 175-S with Neutra-Gas. Quench in either No. 900 Neutral Salt, or in No. 100 Quench Salt which contains a small amount of cyanide. Tempering in salt completes the cycle, free from any deleterious effect caused by contact with the atmosphere.

Park's salt baths, and the knowledge of how to make them do a better job for you, can effect economies in your heat treat department. Write, telling us in detail your application, and we will send you the technical bulletin that covers your particular operation. There is a Park field engineer to assist you, backed by a technical staff and 40 years of Park Chemical Co. service to the heat treating industry. Park Chemical Company, 8074 Military Ave., Detroit 4, Michigan.

AS LINCOLN DIDN'T SAY IT!

One score and sixteen years ago our forefathers brought forth upon this nation a new tax, conceived in desperation, and dedicated to the proposition that all men are fair game.

Now we are engaged in a great mass of calculations testing whether that taxpayer, or any other taxpayer so confused and so impoverished, can long endure.

We are met on Form 1040. We have come to dedicate a large portion of our income to a final resting place with those men who spend their lives that they may spend our money. It is altogether anguish and torture that we should do this. But in a legal sense we cannot evade—we cannot cheat—we cannot underestimate this tax. The collectors, clever and sly, who computed here, have gone far beyond our power to add or subtract. Our creditors will little note nor long remember what we say here, but the Bureau of Internal Revenue will never forget what we report here.

It is for us, the taxpayers, rather to be devoted here to the tax payments which the government has thus far so nobly spent. It is rather for us to be dedicated to the great task remaining before us—that from these vanished dollars we take increased devotion to the remaining few, that we here highly resolve that the next year will not find us in a higher bracket, that this taxpayer, underpaid, shall figure out more deductions, and that taxation of the people, by the Congress, for the spenders, shall not cause our solvency to perish from the earth.

(Anon.)

THE METAL TREATING INSTITUTE

ASSOCIATION OF MASTER CRAFTSMEN

THE MEMBERSHIP - 1951

CALIFORNIA

California-Doran Heat Treating Co.
2850 E. Washington Blvd., Los Angeles 23

Cook Heat Treating Corp.
5934 Alcoa Ave., Los Angeles 11

Lindberg Steel Treating Co.
3537 East 16th St., Los Angeles 23

Industrial Steel Treating Co.
600 Fallon St., Oakland 7

Dexter Metal Treating Co.
1026—77th Ave., Oakland 21

COLORADO

Metal Treating & Research Co.
651 Sherman St., Denver 3

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6

Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 5

ILLINOIS

Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12

Chicago Steel Treating Co.
333 North California, Chicago

Dura-Hard Steel Treating Co.
2333 West Deming Place, Chicago 47

Lindberg Steel Treating Co.
222 North Laflin St., Chicago 7

Pearson Industrial Steel Treating
5757 Ogden Ave., Chicago 50

Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard St., Chicago 22

Fred A. Snow Co.
1942 West Kenzie St., Chicago 22

American Steel Treating Co.
P. O. Box A, Crystal Lake

Eklund Metal Treating, Inc.
721 Beacon St., Love Park

O. T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford

C. U. Scott & Son, Inc.
1510 First Ave., Rock Island

INDIANA

Nerl Heat Treat Corp.
1824 So. Franklin St., South Bend 23

MARYLAND

Maryland Tool Company
111-13 Hollingsworth St., Baltimore 2

MASSACHUSETTS

New England Metallurgical Corp.
9 Alger St., South Boston 27

Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43

Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Anderson Steel Treating Co.
1337 Maple St., Detroit 7

Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4

Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8

Vincent Steel Process Co.
2424 Bellevue Ave., Detroit

MINNESOTA

Metallurgical Control Labs.
2226 East Lake St., Minneapolis 7

MISSOURI

Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15

Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Heat Treating Co.
611 Grove St., Elizabeth

American Metal Treatment Co.
Highway 25 and LaFayette St., Elizabeth

B-M Heat Treating Co.
220 Clifford St., Newark 5

Bennett Steel Treating Co.
246 Raymond Boulevard, Newark 5

L-R Heat Treating Co.
107 Vesey St., Newark

NEW YORK

Fred Heinzelman & Sons
138 Spring St., New York 12

Alfred Heller Heat Treating Co.
391 Pearl St., New York 7

Metro Heat Treat Corp.
466 Broome St., New York 13

Precision Heat Treating Co.
216 William St., New York 7

Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11

Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Cincinnati Steel Treating Co.
Wooster Pike & Mariemont Ave.,
Cincinnati 27

Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 25

Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14

George H. Porter Steel Treating Co.
1265-71 East 55th St., Cleveland 14

Winton Heat Treating Co.
20003 West Lake Road, Cleveland 16

Ferrotherm Co.
1861 E. 65th St., Cleveland 3

Dayton Forge & Heat Treating Co.
2323 East First St., Dayton 3

Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Limekiln Pike, Dresher

J. W. Rex Co.
834 West Third St., Lansdale

Metlab Company
1000 East Mermaid Lane, Philadelphia 18

Wiedemann Machine Co.
4272 Wissahickson Ave., Philadelphia 32

Pittsburgh Commercial Heat Treating Co.
49th St. and A.V.R.R., Pittsburgh 1

TEXAS

Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11

WISCONSIN

Wesley Heat Treating Co.
825 South 21st St., Manitowoc

Hushek Metal Processing Co.
1536 West Pierce St., Milwaukee

Metal Treating, Inc.
720 South 16th St., Milwaukee 4

Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4

Harris Metals Treating Co.
1745 Taylor Ave., Racine

Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14

Wesley Steel Treating Co.
1301-1403 West Pierce St., Milwaukee

Spindler Metal Processing Co.
2338 Mead St., Racine

Wesley Metal Treating Co.
2320 Mead St., Racine

DEPENDABLE...

- Generous Sized Cabinets
- Conditioned Cooling System
- Built-In Checklite System
- Oversized Components
- Filament Voltage Regulation
- Industrial Type Tubes

OR ELSE...

Lindberg's built-in bloodhound—the exclusive "checklite" system—adds the "or else" quality to dependable operation. "Checklites" are a system of indicating lamps that instantly track down any abnormal operating condition at any of the many protective devices.

Yes . . . dependable . . . rugged . . . and versatile! Lindberg Induction Heating Units are designed and built to operate under rigid production requirements far beyond the usual capabilities of Induction Heating Equipment. Like the bloodhound who never quits the trail, these units will serve you 24 hours a day . . . day after day . . . month after month.

Plants throughout the nation report dependable, versatile operation—fast, accurate, selective heating—on tiny pins—on mammoth gears —controlled in both depth of penetration and area covered. Investigate the Lindberg Induction Heating Units—you will profit from their rugged ability to deliver 24 hour a day operation. Ask for Bulletin 1440.

LINDBERG HIGH FREQUENCY DIVISION

Lindberg Engineering Company, 2451 W. Hubbard Street, Chicago 12, Illinois

PSC
Designed-for-Job
CONTAINERS...

SPEED VOLUME ANNEALING OF SMALL ARMAMENT PARTS

The basket in the upper left was designed for an aircraft plant for annealing aluminum and magnesium castings. With movable sides and trays, it cuts handling time materially. The perforated pot at right was furnished a defense contractor for fast handling of small parts at a Homo furnace. Some PSC designed-for-the-job fixtures have eliminated as many as three complete handlings.

Furthermore, PSC welded alloy units save time because, being 2/3 lighter than cast equipment, they handle faster; and require less time to attain pot heat. A recent study of one customer's cycle showed a total saving of 5 hours.

Let our technical staff work with you in devising time-saving units. As pioneers of light-weight, sheet alloy, heat-treating containers and fixtures, we make available to you a wealth of designing and production know-how. We furnish equipment in any size. Send blue-prints or write as to your needs.

PSC "Light Weight"

Heat-Treating Equipment for Any Product and Any Metal

Carburizing and Annealing Boxes
Baskets · Trays · Fixtures
Muffles · Retorts · Racks
Annealing Covers and Tubes
Pickling Equipment
Tumbling Barrels · Tanks
Cyanide and Lead Pots
Thermocouple Protection Tubes
Radiant Furnace Tubes and Parts
Heat, Corrosion Resistant Tubing

THE PRESSED STEEL COMPANY

of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

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